

Unsupervised Medical Image Translation With Adversarial Diffusion Models

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Abstract

Imputation of missing images via source-to-target modality translation can improve diversity in medical imaging protocols. A pervasive approach for synthesizing target images involves one-shot mapping through generative adversarial networks (GAN). Yet, GAN models that implicitly characterize the image distribution can suffer from limited sample fidelity. Here, we propose a novel method based on adversarial diffusion modeling, SynDiff, for improved performance in medical image translation. To capture a direct correlate of the image distribution, SynDiff leverages a conditional diffusion process that progressively maps noise and source images onto the target image. For fast and accurate image sampling during inference, large diffusion steps are taken with adversarial projections in the reverse diffusion direction. To enable training on unpaired datasets, a cycle-consistent architecture is devised with coupled diffusive and non-diffusive modules that bilaterally translate between two modalities. Extensive assessments are reported on the utility of SynDiff against competing GAN and diffusion models in multi-contrast MRI and MRI-CT translation. Our demonstrations indicate that SynDiff offers quantitatively and qualitatively superior performance against competing baselines.